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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,083	06/27/2003	Nicolas Bruno	302692.01	8078

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MICROSOFT CORPORATION
ATTN: PATENT GROUP DOCKETING DEPARTMENT
ONE MICROSOFT WAY
REDMOND, WA 98052-6399

EXAMINER	
CHANNAVAJJALA, SRIRAMA T	
ART UNIT	**PAPER NUMBER**
2166	

DATE MAILED: 10/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/608,083	BRUNO ET AL.	
	Examiner	Art Unit	
	Srirama Channavajjala	2166	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Claims 1-61 are presented for examination.

2. Examiner acknowledges applicant's amendment filed on 7/25/2006.

Drawings

3. The Drawings filed on 6/27/2003 are acceptable for examination purpose.

Information Disclosure Statement

4. The information disclosure statement filed on 8/29/2003 is in compliance with the provisions of 37 CFR 1.97, and has been considered and a copy was enclosed with previous Office Action mailed on 1/25/2006.

Claim Rejections - 35 USC § 112

5. In view of applicant's amendment to claims 1,23,45-46,54-55, the rejection under 35 USC 112 second para as set forth in the previous office action is hereby withdrawn.

Double Patenting

6. In view of applicant's filing "*terminal disclaimer*" on 7/25/2006, the non statutory double patent rejection as set forth in the previous office action is hereby withdrawn.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. ***Claims 1-18, 22-40, 44-61 are rejected under 35 U.S.C. 102(b) as being anticipated by Nicolas Bruno [hereafter Bruno] "Automatic management of statistics on Query expressions in relational database", Ph.D Thesis Proposal, department of computer science, Columbia University, NY, published on April 25, 2002.***

9. As to claim 1, 23,45, Bruno teaches a system which including 'approximating a number of tuples returned by a database query that comprises a set of predicates that each reference a set of database tables' [page 1, line 4-7], Bruno discusses query optimizers specifically using base tables having attributes, tuple[s] are integral part of any relational base tables because each row of the table represents at least one tuple , cardinality is the number of tuples in a relation, and search condition corresponds to predicate [page 1, line 12-13], page 4, fig 2.2];

'(a)expressing the query as a query selectivity' [page 4, example 1, fig 2.2 a-b], Bruno suggests query optimizer for example as detailed in fig 2.2, specifically directed to query selectivity using relational operators in the query optimizer as detailed in fig 2.2;

' (b) determining if the query is separable and if so separating the query selectivity to form a product of query selectivity factors' [page 5, 2.2.1, example 2, page 6, line 1-3], Bruno specifically teaches selection queries having multiple predicates for example as detailed inn page 5, "SELECT * FROM R

WHERE R.a > 10 AND R..b < 100

Where the selectivity for the whole predicate is estimated as detailed in page 6, line 1-2;

'(c) if the query is not separable, decomposing the query selectivity to form a product that comprises a conditional selectivity expression' page 9, 3.2.2, fig 3.1], Bruno specifically teaches various predicates for example equality join, conjunctive [see fig 3.1b], join predicates, further for a given query, the decomposing query into possible sub queries;

'(d) recursively performing steps b)-c) to determine a selectivity value for each query selectivity factor' [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

'(e) matching any conditional selectivity expression with stored statistics to obtain statistics that can estimate the selectivity of the conditional selectivity expressions and using the statistics to obtain an estimated selectivity value' [page 6, 2.2.2, line 12-22, fig 2.4, page 14, example 4, fig 4.1];

'(f) combining the selectivity values obtained in step (d) and the estimated selectivity values obtained in step (e) to estimate the selectivity of the query' [page 15, line 6-18, fig 4.1-4.2].

10. As to claim 46, 54, Bruno teaches a system which including 'approximating a number of tuples returned by a database query that comprises a set of predicates that each reference a set of database tables' [page 1, line 4-7], Bruno discusses query optimizers specifically using base tables having attributes, tuple[s] are integral part of any relational base tables because each row of the table represents at least one tuple , cardinality is the number of tuples in a relation, and search condition corresponds to predicate [page 1, line 12-13], page 4, fig 2.2];

'(a)expressing the query as a query selectivity' [page 4, example 1, fig 2.2 a-b], Bruno suggests query optimizer for example as detailed in fig 2.2, specifically directed to query selectivity using relational operators in the query optimizer as detailed in fig 2.2;

' (b) determining if the query is separable and if so separating the query selectivity by separating the predicates that reference different sets of database tables to form a product of query selectivity factors that reference different sets of database tables' [page 5, 2.2.1, example 2, page 6, line 1-3], Bruno specifically teaches selection queries having multiple predicates for example as detailed inn page 5, "SELECT * FROM R

WHERE R.a > 10 AND R..b < 100

Where the selectivity for the whole predicate is estimated as detailed in page 6, line 1-2;, database tables corresponds to Bruno's base tables,

'(c) if the query is not separable, repeatedly decomposing the query selectivity to form a product that comprises a conditional selectivity expression to generate

alternative products and wherein one of those products is selected to estimate the selectivity of the query' [page 9, 3.2.2, fig 3.1], Bruno specifically teaches various predicates for example equality join, conjunctive [see fig 3.1b], join predicates, further for a given query, the decomposing query into possible sub queries;

'(d) recursively performing steps b)-f) to determine a selectivity value for each query selectivity factor' [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

'(e) matching any conditional selectivity expression with stored statistics to obtain statistics that can estimate the selectivity of the conditional selectivity expressions [page 6, 2.2.2, line 12-22, fig 2.4, page 14, example 4, fig 4.1];

i) 'compiling a set of candidate statistics that can be used to estimate the selectivity of the conditional selectivity expression' [page 12, 3.3, line 1-13], conditional selectivity expression corresponds to SQL query as given in line 9-13];

ii) 'selecting candidate statistics to estimate the selectivity of the conditional selectivity expression based on a selection criteria' [page 12, line 9-13]

iii) 'using the statistics to obtain an estimated selectivity value'[page 12, line 14-15]

11. As to claim 2,24, Bruno disclosed 'multiplying the estimated selectivity by a Cartesian product of the tables referenced by the predicates to obtain a cardinality of the query' [page 4, fig 2.2], Cartesian product corresponds to joining two tables for example see SQL statement in fig 2.2 [a].

12. As to claim 3,25, Bruno disclosed 'separating the query selectivity is performed by separating the predicates that reference different sets of database tables to form a product of query selectivity factors that reference different sets of database tables' [page 5, 2.2.1, page 6, 2.2.3, see SQL statement particularly directed to selection queries having multiple predicates on different attributes of the table;

13. As to claim 4-5,26-27, 50-51, 58-59, Bruno disclosed 'step c) further comprises a query selectivity factor and wherein steps b)-f) are recursively performed to determine a selectivity value for the query selectivity factor in step c) [page 5, line 10-14, page 6, 2.2.2 , fig 2.4];

14. As to claim 6,28, Bruno disclosed 'storing the estimated selectivity of the query obtained in step f) in memory' [page 7, line 5-11].

15. As to claim 7, 29, Bruno disclosed 'estimated selectivity is stored for a query and returning that value to approximate the number of tuples returned by the query' [page 7, line 14-17].

16. As to claim 8,30, 52, 60, Bruno disclosed 'error with the estimated selectivity value that is based on an accuracy with which the statistic matched with the conditional selectivity expression can estimate the selectivity of the conditional selectivity expression' [page 8, line 1-4, page 9, 3.2].

17. As to claim 9,31, 53, 61, Bruno disclosed 'error associated with each conditional selectivity expression to obtain an estimated error for the selectivity estimation for the query' [page 9, 3.3.2, line 1-7].

18. As to claim 10,32, Bruno disclosed 'statistics comprise histograms on results of previously executed query expression' [page 5, fig 2.3, 2.2.1].

19. As to claim 11, 33, Bruno disclosed 'matching the conditional selectivity expressions with stored statistics is performed by compiling a set of candidate statistics that can be used to estimate the selectivity of the conditional selectivity expression' [page 12, 3.3, line 1-13], conditional selectivity expression corresponds to SQL query as given in line 9-13]; 'selecting candidate statistics to estimate the selectivity of the conditional selectivity expression based on a selection criteria' [page 12, line 9-13]

20. As to claim 12,34, 47, 55, Bruno disclosed 'selection criteria for a candidate statistic is determined by computing a number of independent assumptions that are made when the candidate is used to estimate the selectivity of the conditional selectivity expression and the selection criteria is to select the candidate that results in the least number of independence assumptions' [page 10, line 1-16, example 3].

21. As to claim 13,35, 48, 56, Bruno disclosed 'selection criteria for a candidate statistic is determined by comparing the candidate statistic with a base statistic over the same column as the candidate statistic and assigning a difference value to the candidate statistic based on a level of difference between the candidate statistic and the base statistic' [page 13, 4.1, line 1-9,page 14, line 7-13].

22. As to claim 14,36, 49, 57, Bruno disclosed 'compiling a set of candidate statistics is performed by including statistics that are on results of queries having the same tables referenced by the conditional selectivity expression or a subset of the tables referenced by conditional selectivity expression [page 13, 4.2, line 1-6], 'the same predicates over the tables referenced in the conditional selectivity expression or a subset of the predicates over the tables referenced in the conditional selectivity expressions' [page 14, 4.2, line 7-17].

23. As to claim 15,37, Bruno disclosed 'decomposing the query selectivity and matching the conditional selectivity expressions are repeated to generate alternative products and wherein one of those products is selected to estimate the selectivity of the query' [page 15, line 14-16,page 16, line 5-10].

24. As to claim 16,38, Bruno disclosed 'decomposing the query is done by exhausting every alternative way of decomposing the query [page 16, line 4-10]

25. As to claim 17,39, Bruno disclosed 'decomposing the query selectivity to form products of conditional selectivity expressions is performed based on an optimizer search strategy' [page 16, line 11-19].

26. As to claim 18,40, Bruno disclosed 'query is disjunctive and comprising the step of transforming the disjunctive predicates into conjunctive predicates by performing a De Morgan transformation on the disjunctive query' [page 4, fig 2.2, example 1], fig 2.2 a-b represent nodes connected with the same operator for example either conjunction [equivalent to AND operator] or disjunction [equivalent to OR operator] , further De Morgan's law supports inverts logical comparison operators for example reversing logical AND or OR operators where necessary and common knowledge in relational database art.

27. As to claim 22,44, Bruno disclosed 'statistics comprise histograms built over computed columns in a query result' [page 5, 2.2.1, fig 2.3].

Claim Rejections - 35 USC § 103

28. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

> This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

29. **Claims 19-21,41-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Nicolas Bruno [hereafter Bruno] "Automatic management of statistics on Query expressions in relational database", Ph.D Thesis Proposal, department of computer science, Columbia University, NY, published on April 25, 2002 as applied above 1,23 claims further in* view of Acharya et al. [hereafter Acharya], US Patent No. 6477534 filed on Jan 11,2000, published on Nov 5,2002.**

30. As to claim 19,41, Bruno does not specifically disclosed 'query comprises a GROUP BY predicate over a grouping column and wherein the query is transformed prior to performance of the method steps to return a number of distinct values in the grouping column', although Bruno specifically teaches query plan with various predicates for example conjunctive, [see fig 3.1 b], equality join predicates, join predicates and like [page 9, 3.2.1]. On the other hand, Acharya disclosed query comprises a GROUP BY predicate over a grouping column and wherein the query is transformed prior to performance of the method steps to return a number of distinct values in the grouping column' [col 27, line 36-46, fig 10c].

It would have been obvious to one of the ordinary skill in the art at the time of applicant's invention to incorporate the teachings of Acharya et al. into automatic management of statistics on query expressions in relational databases of Bruno because both Acharya, Bruno directed to optimizing query in relational databases [see Bruno: chapter 2, page 3, 2.1; Acharya: col 8, line 61-67], both are directed to query workload [see Bruno: page 20, fig 5.1; Acharya: col 8, line 9-14], and both are directed to statistics on query [Bruno: page 8; Acharya: Abstract] and are from same field of endeavor.

One of the ordinary skill in the art at the time of applicant's invention to incorporate the teachings of Acharya et al. into automatic management of statistics on query expressions in relational databases of Bruno because that would have allowed users of Bruno to use GROUP BY predicate to avoid overheads of query optimization

as suggested by Acharya col 27, line 33-35], further allows to add extra column to each join set relation i.e., query is rewritten to include the extra column group-by-column in the aggregate operator, thus bringing the advantages of generating high-confidence error bounds for the approximate answers, and an efficient maintenance technique for maintaining the statistical summaries in the presence of updates to the database [Acharya: col 5, line 42-47]

.similarly, Claims 20-21, 42-43 are rejected in the above analysis.

Response to Arguments

31. Applicant's arguments filed on 7/25/2006 with respect to claims 1-61 have been fully considered but they are not persuasive, for examiners' response see the discussion below:

a) At page 18-19, claims 1,23,45 applicant argues that Bruno fails to disclose "decomposing the query selectivity to form a product that comprises a conditional selectivity expression. Conditional selectivity is a concept that is neither disclosed nor contemplated in Burno.

b) At page 20-21, claims 46,54, applicant argues that as discussed earlier with respect to claims 1,23,45, the cited sectioin of Bruno fails to disclose decomposing the query selectivity to form .....

As to the above argument [a-b], firstly, Bruno is directed to Statistics on query expressions in relational databases, more specifically statistics built on attributes of the result of a query expression i.e., a model that distribution of tuples on intermediate nodes in a query execution plan that does query optimization [see chapter 1, second paragraph, line 3-6]; secondly, Bruno specifically suggests "cardinality estimation" i.e., statistics on a given table column or combination of columns [see page 4, 2.2., cardinality estimation; page 9, 3.2.], thirdly, Bruno suggests "conditional selective

expression" particularly identifying list of "conjuctive predicates for example fig 3.1(b), classifying predicates as either filter predicates or join predicates [page 9, 3.2.1]. Bruno also suggests using "equal join predicates" from J1 and J3 and table T and U are joined, particularly denoting the tables T and U in the decomposing the query referring to the filter predicates marked with "F" label. Therefore, Burno clearly assert "decomposing the query selectivity to form a product that comprises a conditional selectivity expression. More particularly, it is an object to define and provide "statistics on intermediate tables" [chapter 3, page 9, 3.2 – 3.2.2]. As best understood by the examiner "decomposition of the query" nothing but separating elements of a query so that each can be processed, Burno specifically suggests "decomposition of the query" for example as detailed in page 10, fig 31, also in query execution plan in fig 3.2.

It is noted that Applicant's remarks, at page 17-22 of the response, are merely conclusory statements, without any support clearly discussing . Applicant is merely repeating the language of the claim, without addressing Examiner's particular interpretation of the reference, as presented in the previous Office action, and without specifying how the instant claims address the issues raised by Examiner. Accordingly, Examiner maintains the interpretation of the reference as previously presented.

c) At page 19-20, claims 1,23,45, applicant argues that Bruno does not disclose step c) either expressly or inherently, and therefore, it is not possible for Bruno to disclose "recursively performing step c)

d) At page 21, claims 46,54, applicant argues that "recursively performing steps b)-c) to determine a selectivity value ....as discussed previously, examiner is again respectfully requested to apply the previous discussion with regard to the rejection to claims 1,23,45 to the present rejection ....

As to the above argument [c-d], as best understood by the examiner, Bruno is directed to query expression in relational databases, more specifically, "statistics on query expressions" generally suggests how the cardinality estimation using "statistics on intermediate tables", analysis of the input query plan with respect to optimization [see chapter 3], further, Bruno also suggests how each selection queries that including join queries, select project join queries " in estimation of cardinality in the statistics on intermediate table see chapter, 3.2, also it is general knowledge in the database art that "fullselect that seeds the recursion and an iterative full select that contains a direct reference to itself in the FROM clause"[see page 5, "selection query"] because recursive queries can be implemented by defining table view or at least table expression, therefore, Bruno teaches recursively performing steps b)-c) to determine a selevitity value for each query .

Therefore, applicant's remarks are deemed not to be persuasive, and claims *1-18, 22-40, 44-61 are rejected under 35 U.S.C. 102(b) as being anticipated by Bruno "Automatic management of statistics on Query expressions in relational database", Ph.D Thesis Proposal, department of computer science, Columbia University, NY, published on April 25, 2002.*

In response to applicant's arguments at page 21-22, examiner applies above discussed arguments and maintains claims 19-21,41-43 stand rejected under 35 USC 103(a) as being unpatentable over Bruno in view of Acharya et al. US Patent No. 6477534

Conclusion

The prior art made of record

a. Nicolas Bruno "Automatic management of statistics on Query expressions in relational database, published on April 25, 2002

b. US Patent. No. 6477534

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Srirama Channavajjala whose telephone number is 571-272-4108. The examiner can normally be reached on Monday-Friday from 8:00 AM to 5:30 PM Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alam, Hosain, T, can be reached on (571) 272-3978. The fax phone numbers for the organization where the application or proceeding is assigned is 571-273-8300 Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free)

sc
Patent Examiner.
October 2, 2006.

SRIRAMA CHANNAVAJJALA
PRIMARY EXAMINER